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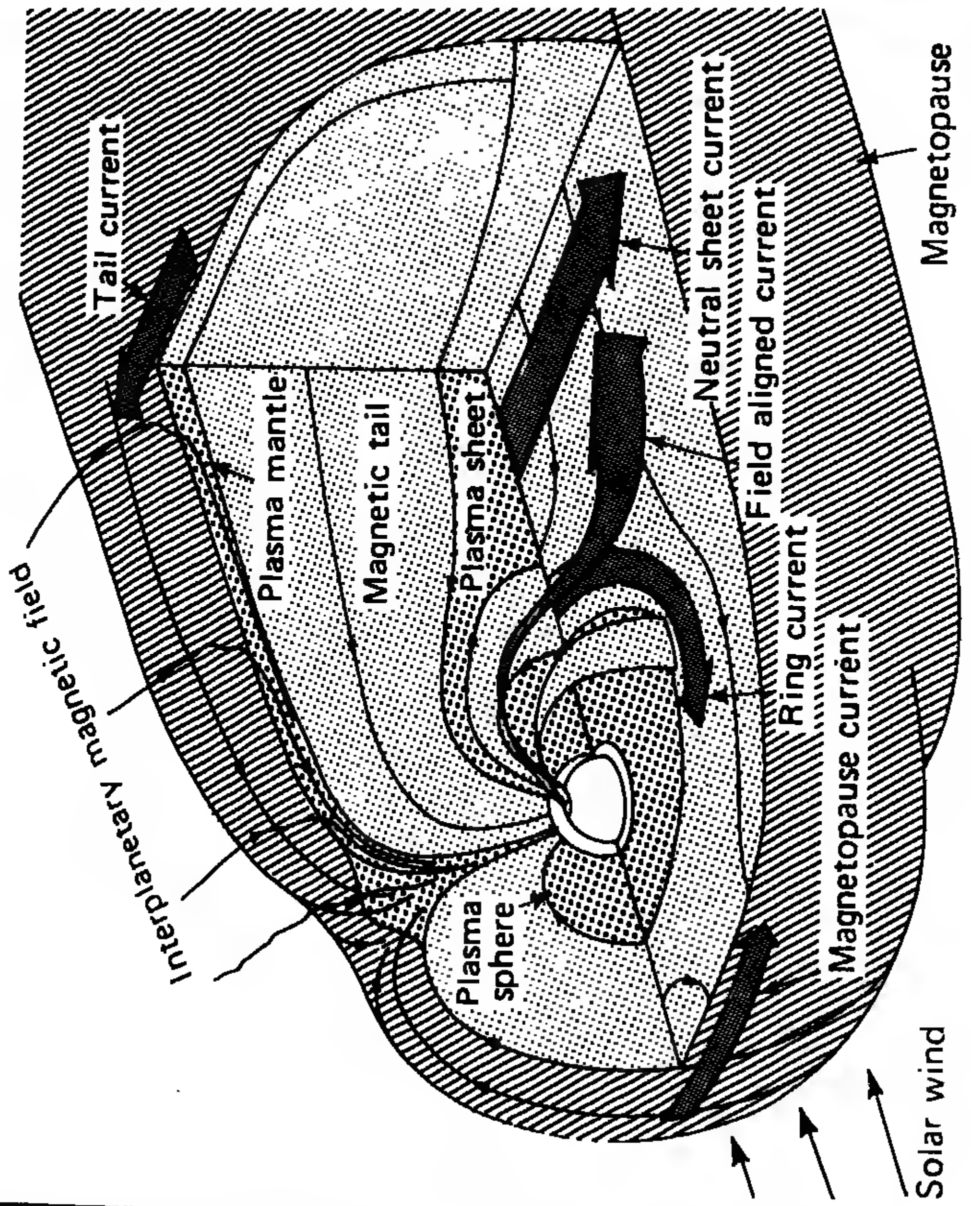


Eos, Transactions, American Geophysical Union Vol. 65, No. 5, Pages 33–40 January 31, 1984

News

Iridium at Kilauea

Trace-element anomalies observed in rocks located stratigraphically at the Cretaceous-Tertiary boundary are considered significant evidence that the boundary is a record of a large meteorite impact (*Science, 208,* 1095–1108, 1980). In particular, trace metals, including iridium and other members of the platinum metals group, are thought to be enriched in rocks alien to the earth's surface. These elements are indeed enriched in meteorites relative to earth crustal rocks, but new evidence from analyses of the January 1983 eruption of Kilauea suggest that the analogy may be invalid. W. H. Zoller, J. R. Parrington, and J. M. Phelan Kotra reported neutron activation analyses of airborne particulate matter collected at the Mauna Loa Observatory and found "strikingly" large concentrations of iridium in addition to element concentrations expected from volcanic emissions (*Science, 222,* 1118, 1983). The only other platinum-group trace metal analyzed was gold, which was also found to be anomalously high. They concede that they need more data of other platinum group elements and more data on other volcanos, but the implication is that the Cretacious-Tertiary boundary may well be volcanic, not due to a large meteorite impact.

The matter of the effects of large meteorite impacts on the earth's surface probably will not be settled by this study, and the question of the origin of the Cretaceous-Tertiary boundary probably will not be answered satisfactorily either. What is important to be learned from the Kilauea results is that trace element constraints, often thought to be so tightly bound, require broad geological analysis for their interpretation. Meteorites and the processes attendent to their origin are not understood, and yet it has been acceptable to assume their pristine role in our solar system and in setting standard element concentration levels of primordial matter. More meaningful for Zoller et al. was to look at enrichment factors of Kilauea plume samples relative to Hawaiian basalt, rather than, say, only to chondrites. For example, the iridium to aluminum ratio in the plume samples was found to be 17,000 times that of Hawaiian basalt.

Zoller et al. were careful not to overstate the value of their observations as they may reflect on interpretations of the Cretacious-Tertiary boundary. They note immediately that the Kilauea volcano of 1983 is much too small to have had world-wide effects. The iridium content of the recent eruption was only about 9 kg compared with 180 ktonnes estimated for the mass of iridium deposited along the Cretaceous-Tertiary boundary. But, they also note that there were volcanoes that had the necessary volume: "If volcanism was instrumental in producing the K-T boundary layer, the volcano was certainly not Kilauea but may have been similar to the one that formed the Decan Flood basalts."—*PMB*

Stratospheric Sulfate Particles

As part of scientific activities of the Middle Atmosphere Program in Japan, the direct sampling of trace gases and aerosols in the lower stratosphere has been planned by using Merlin-IV aircraft. Most of the flights have been performed during winter, since Merlin-IV can reach the lower stratosphere only during cold seasons at latitudes of 36°-40°N. During the sampling flights, concurrent with the aerosol sampling, O_3 mixing ratios were measured simultaneously from aircraft by using a modified airborne ozonesonde. The O_3 mixing ratio is used as tracer of stratospheric air and, together with radiosonde records of the Japan Meteorological Agency's local weather stations is a good indicator of the height of the tropopause along the flight track.

On February 20, 1983, Merlin-IV sampled aerosols by impaction in the lower stratosphere over the Sea of Japan (36°-40°N, 137°E). During the sampling flight, we concentrated efforts to obtain the actual molecular form of stratospheric sulfate particles by applying a vapor-deposited thin film of calcium as a reactive, particle-collecting surface. Chemical testing by the calcium thin film is a specific test for the detection of the sulfuric acid component in individual submicron particles under low ambient relative humidities (A. Ono et al., *Tellus, 35B,* 197–203, 1983).

Electron micrographs of stratospheric particles in the lower stratosphere at an altitude of 8.3 km, collected by impaction on a reactive surface precoated in vacuum with calcium, show that almost all particles etched a calcium thin film and formed reaction spots spread around particles. This indicates clearly that dominant particles were present as a liquid droplet in the lower stratosphere, and the most probable liquid which reacts directly with calcium upon impaction under stratospheric condition is obviously hydrated sulfuric acid.

The morphology of particles collected on a carbon thin film at the same flight level showed an appearance similar to that of sulfuric acid droplets characterized by small satellite droplets surrounding a central particle. Although the morphological identification of particle chemistry with electron microscopy does not always reflect the actual molecular form of sulfate particles, in the present case the morphology of the stratospheric particles supports the results obtained by a thin film technique of calcium.

This news item was contributed by Akira Ono, *who is with the Water Research Institute, Nagoya University, Nagoya, 464, Japan.*

El Niño Study

A National Research Council (NRC) committee has laid the foundation for a coordinated, decade-long study of the ocean-atmosphere interactions associated with the El Niño and the Southern Oscillation. The plan describes itself as intended to "serve as a mechanism for engendering a vigorous international program required to address the global problem."

The Southern Oscillation (SO) is a recurrent seesawing of atmospheric mass between the Pacific and Indian oceans in the tropics and subtropics that plays havoc with the global climate by changing wind, temperature, and rainfall in the monsoon regions, the central and western equatorial Pacific, and throughout the tropics. The El Niño (EN), a related phenomenon, is an anomalous, periodic warming of the waters off South America that in turn affects atmospheric circulation patterns, producing erratic weather patterns. Together, the phenomena are known as ENSO.

The Climate Research Committee of NRC's Board on Atmospheric Sciences and Climate outlined the scientific rationale and objectives for an ENSO program and sketched a blueprint of observational and research programs to address these objectives. "This global-scale and almost inescapably international research program is based on a number of existing or planned elements that have already been developed for other compatible motivations," the report states.

Current research programs studying parts of the Southern Oscillation "do not have a framework for coordination and overall management commensurate with the global nature of the problem they are addressing," according to *El Niño and the Southern Oscillation: A Scientific Plan.*

As outlined by the Climate Research Committee, the ENSO scientific program would center on three major components. The first would monitor for a decade atmosphere-ocean interactions associated with ENSO; describe in more detail a representative El Niño episode spanning 15–18 months; and provide "detailed information concerning the processes that control the sea-surface temperature and the fluxes at the atmosphere/ocean surface."

The second component would deal with upgrading and analyzing those historical data sets that describe ENSO events during the last 30 years and those that, though limited, describe ENSO behavior over the last century. The last component would focus on atmosphere-ocean interactions relevant to ENSO and to developing the ability to predict ENSO events.

The ENSO scientific plan "is visualized as a [United States] component" of the newly defined international program, called TOGA, that will study the interannual variability of the Tropical Ocean and the Global Atmosphere.

The committee concentrated on the study outline and did not consider issues associated with manpower, resources, or costs.

Copies of the committee's 72-page report are available from the Board on Atmospheric Sciences and Climate, 2101 Constitution Ave., N.W., Washington, DC 20418. Joseph Smagorinsky is chairman of the Climate Research Committee.

Geophysical Events

This is a summary of *SEAN Bulletin, 8*(12), December 31, 1983, a publication of the Smithsonian Institution's Scientific Event Alert Network. The Mt. St. Helens, Sakurajima, and earthquake reports are all excerpts. The complete bulletin is available in the microfiche edition of *Eos* as a microfiche supplement or as a paper reprint. For the microfiche, order document E84-001 at $2.50 (U.S.) from AGU Fulfillment, 2000 Florida Ave., N.W., Washington, DC 20009. For the paper reprint, order *SEAN Bulletin* (giving volume and issue numbers and issue date) through AGU Separates at the above address; the price is $3.50 for one copy of each issue number for those who do not have a deposit account, $2 for those who do; additional copies of each issue number are $1. Subscriptions to *SEAN Bulletin* are available from AGU Fulfillment at the above address; the price is $18 for 12 monthly issues mailed to a U.S. address, $28 if mailed elsewhere, and must be prepaid.

Volcanic Events

Kilauea (Hawaii): Phase 12 described; tremor and inflation continue; new ground cracks

Mt. St. Helens (Washington): Renewed extrusion on NE flank; breadcrust bombs

Veniaminof (Alaska): Vapor plumes; incandescence; earthquakes

Pavlof (Alaska): Brief ash emission episodes

Piton de la Fournaise (Réunion): Lava emission continues; volcanic tremor; most deformation in ½–¾ hour, 2 hours before pre-eruption seismic swarm

Rabaul (New Britain): More but weaker earthquakes; deformation slows

Bagana (Solomon Islands): Glow, explosions, incandescent boulders

Langila (New Britain): Tephra to 2.7 km height; small lava flow

Ulawun (New Britain): Seismicity increases after M 6.4, 6.5 earthquakes

Manam (Bismarck Sea): Glow, tephra ejection, explosions at summit craters

Kusatsu-Shirane (Japan): Summit explosions and seismicity

Sakurajima (Japan): Tephra from strong explosions damage cars and buildings

Usu (Japan): Fumarole temperatures decline slightly

Atmospheric Effects: Balloon and lidar data and colorful sunsets indicate continued presence of El Chichón aerosols

Mt. St. Helens Volcano, *Cascade Range, S Washington, USA (46.20°N, 122.18°W).* Growth of the composite lava dome has continued since early 1983. Internal expansion accelerated before the onset of lava extrusion in February and continued as spines formed in April and a new lobe emerged onto the NE flank about May 1. The lobe advanced and rapid NE flank deformation continued as rates of outward movement on the S and SE flanks began to increase in July. In late September lava was redirected to the S side of the active lobe, accompanied by continued vigorous S and SE flank deformation. Following this shift of activity to the south, advance of the lobe's NE end stopped by the end of October and NE flank deformation was negligible by November.

Lava reached the dome's steep upper S and SE flanks in December, spawning numerous rockfalls as the lobe front broke up. Some rockfalls were hot enough to become fluidized, moving down a chute and spreading over a small area of the crater floor at the base of the dome. The fluidized rockfalls from the front of the NE flank lobe in August (*Eos,* October 11, 1983, p. 586) were larger and had stronger seismic signatures. Maximum deformation rates measured on the S and SE sides of the dome dropped from about 50 cm per day in late November to about 20 cm per day by late December. Between December 28 and January 4, values increased sharply to as much as 60 cm per day.

New lava appeared on the NE flank in mid-December, forming jagged spires and ridges, but little downslope advance was observed. Instead, the lava appeared to have broken through the crust of the dome in a zone that extended about 200 m NE from the summit spine and was about 100 m wide (in a NW-SE direction). Deformation of the NE flank also began to accelerate in mid-December, increasing from ½–1 cm per day to a few centimeters per day by the end of the month.

The dome's summit spine crumbled rapidly, but continued to receive some new lava. As of early January several meters of net height loss appeared to have occurred. Snow had accumulated in the depression that formed in November near the top of the dome, but its NW rim tilted dramatically away from the remainder of the depression, and a new mound had grown in that area.

Gas and ash ejection from vents high on the dome continued to occur several times per day. On December 16, a substantial number of breadcrust bombs with a maximum diameter of about 4 cm were found in the crater on snow that had probably fallen 2 days earlier. The bombs were more vesicular than any material ejected by Mt. St. Helens since the strong explosive activity of March 19, 1982, (*Eos,* April 6, 1982, p. 220). December SO_2 emission averaged 105 ± 25 metric tons per day, a 30–40% increase over October and November values, but similar to rates measured April–September 1983.

Seismic events were slightly more numerous in December, but only minor growth was observed in the rate of energy release. There were no obvious changes in seismicity that could be correlated with changes in activity on the dome.

Information Contacts: Donald Swanson and Tom Casadevall, USGS Cascades Volcano Observatory, 5400 MacArthur Blvd., Vancouver, WA 98661; Robert Norris, Geophysics Program, University of Washington, Seattle, WA 98195.

Sakurajima Volcano, *Kyushu, Japan (31.58°N, 130.67°E). All times are local (= UT + 9 hours).*

Recorded explosive eruptions from the summit crater of Minamidake were frequent in August (39) and September (36), fewer in October (21) and November (16).

In mid-August strong wind carried a large amount of ejecta to the inhabited area around the volcano, damaging cars and houses. On August 14 lapilli as large as 6–7 cm in diameter fell on Nojiri, at the foot of Sakurajima 4 km SW of Minamidake, breaking or cracking windshields on 16 cars, a house's window pane, and the roof of a hut. Radio news from Kagoshima reported that windshields on 3 cars were cracked by lapilli as large as 1–3 cm in diameter at Tarumizu Wharf, on the S side of the city (15 km NW of the crater). An explosion at 0153 on August 16 scattered lapilli up to 2.5 cm in diameter between Mochiki and Yunosu (3.5 km SSW of Minamidake), where windshields on 26 cars were cracked.

Explosive activity remained strong in September. Incandescent blocks from an explosion at 1148 on September 12 started a flank forest fire. A heavy ashfall on September 17–18 deposited 0.270 kg m⁻² of ash at the Japan Meteorological Agency's Kagoshima Observatory (10 km W); a Kagoshima streetcar derailed on September 19 due to ash on the tracks. An explosion at 1518 on September 20 produced a large air shock that broke window panes in Kagoshima, and another explosion at 1638 sent lapilli as large as 1 cm in diameter toward the N. A total of 5 debris flows moved down valleys on the S flank of Sakurajima on 1, 10, 20, and 21 September. There were frequent bursts of discrete seismic events in September. Bursts on September 19 and 28 lasted for about 10 hours and included large events.

Information Contact: Office of Volcanic Observation, Seismological Division, Japan Meteorological Agency, 1-3-4 Ote-machi, Chiyoda-ku, Tokyo 100, Japan.

Earthquakes

The earthquakes on December 21 and 22 near New Britain were centered off the island's S coast about 150 km S of Rabaul and SE of Ulawun volcano.

Modified Mercalli intensities were IV at Rabaul, V at Ulawun. Geologists at the Rabaul Volcano Observatory report, "Motion at Rabaul was considerable but not abrupt, and no reports of damage or casualties were received from anywhere in the New Guinea islands region. The first earthquake triggered 3 felt harbour shocks at Rabaul at 0004, 0005 and 0006 GMT on 22 December, and both earthquakes and their numerous aftershocks may have contributed to causing the seismic crisis which occurred at Ulawun Volcano from 23–26 December."

The shock in W Africa on December 22 killed 443 persons in W Guinea, and left about 150 seriously injured, more than 200 missing, and an estimated 15,000 homeless. Damage was extensive in the cities of Gaoual and Koumbia about 40 km SE and S of the epicenter and about 250 km N of the capitol of Conakry. At least 16 villages in the area were destroyed. The event was felt throughout Senegal, Gambia, Guinea-Bissau, Guinea, and Sierra Leone.

The December 31 earthquake centered in NE Afghanistan killed 12 persons in collapsing buildings and injured at least 10 in N Pakistan, in the triangular region formed by Chitral (about 150 km SE of the epicenter), Peshawar (about 250 km SSE), and Pattan (about 250 km SE). In Kabul, Afghanistan, 6 persons were reported injured and many buildings damaged.

Information Contacts: National Earthquake Information Service, U. S. Geological Survey, Stop 967, Denver Federal Center, Box 25046, Denver, CO 80225; P. Lowenstein, Principal Government Volcanologist, Rabaul Volcano Observatory, P.O. Box 386, Rabaul, Papua New Guinea.

Meteoritic Events

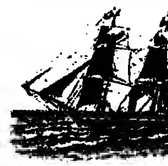
Fireballs: Brazil; Czechoslovakia; England; Netherlands (2); New Zealand; Portugal; Illinois, Maryland, Oregon, Texas, USA; N-central USA–S-central Canada.

Earthquakes

Date	Time (UT)	Magnitude	Latitude	Longitude	Depth of Focus	Region
December 2	0309	7.1M_s*; 6.7M_s**	14.05°N	91.94°W	65 km	Guatemala
December 21	2232	6.4M_L; 6.4M_s	5.51°S	152.47°E	shallow	New Britain
December 22	0102	6.5M_L; 6.5M_s	5.50°S	152.47°E	shallow	New Britain
December 22	0411	6.3m_b; 6.2M_s	11.98°N	13.54°W	10 km	NW Africa
December 30	2353	7.0m_b	36.34°N	70.97°E	154 km	NE Afghanistan
December 31	0904	7.0m_b	33.83°N	136.86°E	389 km	Japan

*University of California, Berkeley.
**Lamont-Doherty Geological Observatory, Palisades, N.Y.

The Oceanography Report



H.M.S. Challenger returning to Sheer, 1872

The focal point for physical, chemical, geological, and biological oceanographers

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The Year in Review

D. James Baker

This article is not a summary of all or even most of the important and interesting activities carried out in oceanography during the past year; the field is simply too large and active for that. One must look to the periodic reports of the International Union of Geodesy and Geophysics for a proper summary. Rather, this is my view of some of the scientific and programmatic events this year that could have interest for the readers of *Eos*.

The year 1983 was an exciting one, filled with intense activity by oceanographers in all disciplines. The year started with confirmation that we were indeed experiencing a major and unusual El Niño. The awareness of the role of the ocean in climate variation was enhanced both by the severity of the El Niño and the new reports on the effect of increasing CO_2 in the atmosphere.

The year continued with remarkable demonstrations of the power of satellite-borne instruments to reveal new physical, biological, and geological features of the ocean. We saw the retirement of the *Glomar Challenger* as a deep sea drilling vessel after 15 successful years and the start of a major new drilling program destined to be aboard a larger vessel. The year ended with planning for new, expanded studies on the interaction of the tropical ocean with the global atmosphere and on the general circulation of the ocean. The prospects of global studies of biogeochemical fluxes were under discussion.

Much has already been written about the strength and development of the 1982–1983 El Niño/Southern Oscillation which (thanks to the early planning efforts of scientists in the NOAA Equatorial Pacific Ocean Climate Studies program and the NSF Pacific Equatorial Ocean Dynamics program) was one of the best-documented ever. A full review of the oceanography, meteorology, and biological consequences of the event is available in the articles by Cane [1983], *Rasmusen and Wallace* [1983], and *Barber and Chavez* [1983].

It is worth noting here that the unusual evolution of the event caught many oceanographers by surprise (G. Philander, Comments on the 1982–1983 El Niño, unpublished manuscript, 1983). During a typical event, exceptionally warm surface waters first appear off Peru and Ecuador in January and February and then expand westward. However, as late as September 1982 conditions off South America were still normal. At the conference on El Niño at Princeton in October 1982 sponsored by the Committee on Climate Research of the National Research Council, there was controversy over whether or not an El Niño was in progress. In reality the event had already started in the western tropical Pacific in May 1982 and was expanding eastward. The event persisted into July 1983, and by early September conditions were only slightly anomalous.

The Committee on Climate Research [*National Research Council*, 1983a] notes that the 1982–1983 event had an exceptionally large amplitude and was associated with unusual climatic events around the globe. Sea levels dropped in the western Pacific and flooding occurred in tidal estuaries in South America. Dramatic shifts in precipitation patterns were observed. Widespread drought occurred over Australia, Indonesia, Southern India, Sri Lanka, and Africa. The impact on fisheries of the loss of upwelled, nutrient-rich water was severe and widespread. Overall, the meteorological and ecological effects associated with the event directly affected the lives of hundreds of millions of people all over the world.

The El Niño emphasized the need for new studies in the tropics. Interannual climate variability is of major practical importance, and tropical air-sea interaction is key to interannual variability. It is in the tropics that the ocean and the atmosphere are closely coupled on these monthly to interannual time scales. There is a growing belief that the El Niño/Southern Oscillation is not just a collection of isolated and independent oceanographic and meteorological events, but a global entity in which interactions between the tropical Pacific Ocean and the global atmospheric circulation are the primary driving forces.

It is this belief that is driving the planning for part of the oceanography of the World Climate Research Program (WCRP), sponsored by the World Meteorological Organization, the International Council of Scientific Unions, the Intergovernmental Oceanographic Commission (IOC), and the Scientific Committee on Oceanic Research (SCOR). New measurements and modeling of the tropical ocean and its interaction with the atmosphere that are essential to improving our understanding have been identified by the SCOR/IOC Committee on Climatic Changes and the Ocean (CCCO) under a program called TOCA (Tropical Ocean and Global Atmosphere). Satellite measurements of surface wind stress and in situ studies of circulation and mixing will be important parts of this program.

In recognition of the fact that the general ocean circulation must be understood before the role of the ocean in climate variability can be elucidated, the second major oceanographic activity of the CCCO is the planning for a World Ocean Circulation Experiment. A number of papers published this year showing the new results that are now possible with global satellite data have helped to support this planning.

The Seasat altimeter data continued to reveal global information about the shape and variability of the ocean surface, as investigators found implications for study of wind stress, ocean circulation, eddies and meanders, and the marine geoid thanks to continuing support of this data analysis by the National Aeronautics and Space Administration (NASA) [see *Seasat Special Issue II*, 1983]. To see these features on a global scale, even if only for the 3-month Seasat lifetime, is a new thing for oceanographers, and much interest has been generated by this work. It should also be noted that the coastal zone color scanner on Nimbus 7, launched the same year as Seasat but still in orbit, has provided the biological oceanographers with another rich source of data on variability of near-surface chlorophyll and other light-absorbing substances.

International planning is now under way to document the need for a dedicated satellite mission for ocean circulation. In the summer of a workshop on global measurements of the ocean, sponsored by the U.S. National Research Council's Board on Ocean Science and Policy and Board on Atmospheric Sciences and Climate concluded that a World Ocean Circulation Experiment (WOCE) was feasible and timely and that detailed planning should begin immediately.

The overall goals of WOCE, as identified by the workshop, are to determine the 3-dimensional circulation of the ocean for a period of several years, to improve the description of the atmospheric boundary conditions of the ocean at the same time, to describe the upper boundary layer of the ocean for estimates of water mass transformation, determine the role of interbasin exchanges, and determine the role of ocean heat transport and storage in the heat budget of the earth. Satellite measurements of the sea surface slope to yield geostrophic currents will be a key component of this program.

In situ measurements will also be key to WOCE, and important new results were reported this year from such studies. The Transient Tracers in the Ocean program reported a significant and widespread decrease in salinity in the North Atlantic, occurring over the past 2 decades. This implies a relatively rapid response of deep water formation to climatic perturbation [*Brewer et al.*, 1983]. In addition, four new hydrographic sections in the South Atlantic Ocean were completed, thus further extending our baseline information in this area. Evidence continued to build for connections between surface processes and sediment deposition through measurements of seasonal changes of the sediments and sediment trap studies in the water column.

During the year a major report on "Changing Climate" [*National Research Council*, 1983b] was issued by the Carbon Dioxide Assessment Committee, chaired by William A. Nierenberg, director of the Scripps Institution of Oceanography. This report has provided the strongest evidence yet on the serious consequences of the predicted general warming of the atmosphere from increased CO_2 in the atmosphere. The potential rise in sea level from the melting of the ice caps was noted as a special problem. The crucial role of the ocean in absorbing excess CO_2 and hence delaying a warming was noted; but models are still too crude to account for this effect correctly.

As part of the search for observable effects of atmospheric warming due to CO_2, a series of papers in recent years has shown an apparent global sea level rise. During the past year, *Barnett* [1983] showed that the observed apparent rise in sea level globally was probably not due to steric effects from heading. Barnett notes that these conclusions are tentative and that better global data will be needed to draw unambiguous conclusions. We need long time series of mean sea level, temperature, salinity of the ocean, and the extent of sea ice before we can know the true response of the oceans to atmospheric warming.

Barnett's work was but one of many inputs into the third major planning effort carried out by CCCO, which was on long-term ocean observations. Francis Bretherton is chair of the committee, which for the first time has laid down a detailed plan for a large-scale observing system based on proven techniques. The committee report, "Ocean Observational Systems," now in draft, also addresses the unsolved scientific, technological, and data management issues that remain to be solved. The need for limited duration exploratory observing systems and the necessity for the design of pilot observing systems is emphasized in this report.

Techniques for in situ measurements lending to long-term measurements for ocean observing systems reached important milestones during the year. The first intermediate mooring in the Gulf Stream (intermediate in the sense of extending up into the stream itself) was recovered this year by scientists from the Woods Hole Oceanographic Institution, showing that such techniques may be ready for use in experimental time series programs. The NOAA Subtropical Atlantic Climate Studies program showed a successful use of a variety of techniques to monitor the Gulf Stream in the Florida straits. These techniques will be used in the design of a program to measure heat flux in the subtropical Atlantic as part of the World Climate Research Program. Deep drifters that pop up and report their position by satellite, thus revealing deep averaged currents, were also successfully tested during the year, yielding another tool for the study of large-scale circulation.

The development of satellite programs for physical oceanography continued as plans became firmer for a Navy Remote Ocean Sensing System (NROSS), involving also NASA and the National Oceanic and Atmospheric Administration. If funded, NROSS will measure surface wind stress and wave properties globally starting in 1988. The Topography of the Ocean Experiment (TOPEX), NASA's initiative for the flight of a precision altimeter to measure accurately the shape of the ocean surface, received new momentum with a French offer to share the launch and other costs.

The year saw the retirement of the research vessel *Glomar Challenger*, whose 96 expeditions since 1968 set an unmatched record of exploration into the least known parts of the earth's crust. The *Challenger* was the major seagoing facility of the Deep Sea Drilling Project (DSDP), funded by the National Science Foundation and operated by the Scripps Institution of Oceanography. The project has been guided scientifically by a number of international panels and committees, under the auspices of the Joint Oceanographic Institutions for Deep Earth Sampling, currently a group of 10 U.S. and 5 non-U.S. institutions.

Major scientific accomplishments of the DSDP such as verification of the sea floor spreading model, demonstration of the large-scale vertical movements of the sea floor, and the reconstruction of past chemical, physical, and biological ocean environments that were different from those of the present have already made international scientific headlines. However, the DSDP's most enduring contributions have been the building of a reconnaissance-scale geological section of the sediments and surface of the basalt basement that constitute the upper part of the oceanic crust.

However, the reconnaissance section is based upon only one data point for each 250,000 square miles of the world ocean. It is clear that further investigation of this section, its variations, and its relation to continental crust hold the promise of major advances in understanding the history, composition, structure, and resources of the earth. For these reasons, the international marine geological and geophysical community has developed a new drilling program based on a larger and more capable drilling ship. The new Ocean Drilling Program is now in the process of selecting a ship from a commercial contractor. The program, funded by the National Science Foundation, will again be guided by the Joint Oceanographic Institutions Deep Earth Sampling. It will be operated from Texas A&M University; the first expedition is scheduled for late 1984 [*Eos*, January 31, 1984, p. 33].

During the year, the geology and geochemistry of hydrothermal vents remained a preoccupation of marine scientists. Of particular interest are the fluid-rock interactions and sulfide mineralization processes. The biological communities in and around these vents also were a major focus for biological oceanographers and marine biologists, who continue to explore the biochemistry and biology of these apparently unique organisms, including bacteria that can live at 300°C.

New technologies showed the way to new descriptions of geophysical phenomena. The side-scan sonar and multibeam echosounding instruments [*Farnari et al.*, 1983] give a 2-dimensional view of the ocean floor. The tectonics of ridge crests is beginning to be studied in earnest with these and other techniques.

Satellite techniques were also important to the geophysicist. A full view of the large-scale features of the ocean floor, as reflected in the shape of the ocean surface, was produced for the first time from Seasat altimeter data [*Haxby et al.*, 1983]. In addition, it was shown that new processing techniques allowed the extraction of geological features on scales on the order of 50 to 100 km with special processing techniques. These new pictures can be used to locate seamounts and other small-scale features of the ocean floor.

Of special note on facilities in addition to the planned new vessel for ocean drilling: the *Atlantis II*, originally designed as an all-purpose oceanographic research vessel, was reconfigured to operate as a tender for the submersible *Alvin*, thus giving the latter a much larger range and providing much-needed space. An ocean modeling facility was in the planning stages at the National Science Foundation, with access to an Advanced Vector Computer at the National Center for Atmospheric Research being the central element.

Among those organizations of interest to oceanographers, the National Research Council (NRC) plays an important role. During the year, the NRC recombined the Ocean Sciences Board and the Ocean Policy Committee into a single Board on Ocean Sciences and Policy (*Eos*, June 7, 1983, pp. 402–403). The new board's terms of reference include charges to continue oversight and stimulation of ocean sciences, help formulate marine policy, and help clarify scientific issues that affect ocean policy. At the same time, Richard C. Vetter who had served as executive secretary of the board in its many manifestations through the years, retired; AGU's Ocean Sciences Section presented him with its Ocean Sciences Award for his outstanding service.

Under the leadership of the new chairman, John Slaughter, Chancellor of the University of Maryland, and Nancy Maynard, the newly appointed executive secretary, the Board on Ocean Sciences Policy immediately began planning for a major study on "National Strategies for Ocean Science and Policy to the year 2000." The study will articulate community consensus on issues critical to improving ocean science and policy in the next 2 decades and by so doing provide guidance to those involved in ocean science and policy decision making. The study is being developed by the board in response to a long-standing need by the ocean agencies for a long-range plan for the ocean sciences and related policy matters.

The study will be carried out in two parts. In the first part, a disciplinary one, a balanced panel of experts will critically assess its files and identify those research areas within the field that are likely to return the highest scientific dividends as a result of new support. This phase will be carried out in the first half of 1984. The second part will build on the results of the first to identify linkages which could yield fruitful advances in either science or policy. Wide community involvement is expected in this effort which, if successful, could reap benefits for the ocean sciences for a long time to come.

As the year ended, the announcement by the U.S. Government that it planned to pull out of the United Nations Educational, Scientific, and Cultural Organization injected uncertainty into the U.S. role in the Intergovernmental Oceanographic Commission, a key component of operational oceanographic measurements. Long-time observers of the scene urged caution in drawing conclusions as to the effect of such a U.S. action, but such a change could have major effects on the formalities of international planning.

On a more positive note, a number of ocean groups, including federal, industrial, and private organizations, are now actively planning for a year-long program of ocean awareness to be called the Year of the Ocean, starting March 10, 1984. The date is chosen as the first anniversary of the U.S. proclamation on the Exclusive Economic Zone. The exercise of sovereign rights for exploring, developing, conserving, and managing the living and nonliving resources of the sea requires an initiation of new activities; the new year will see many of these.

References

Barber, R. T., and F. P. Chavez, Biological consequences of El Niño, *Science*, *222*, 1203–1210, 1983.

Barnett, T. P., Long-term changes in dynamic height, *J. Geophys. Res.*, *88*, 9547–9552, 1983.

Brewer, P. G., W. S. Broecker, W. J. Jenkins, P. B. Rhines, C. G. Rooth, J. H. Swift, T. Takahashi, and R. T. Williams, A climatic freshening of the deep Atlantic north of 50°N over the past 20 years, *Science*, *222*, 1237–1239, 1983.

Cane, M. A., Oceanographic events during El Niño, *Science*, *222*, 1189–1195, 1983.

Farnari, D. J., W. B. F. Ryan, and P. J. Fox, Sea MARC I side-scan sonar imaging near the East Pacific rise, *Eos Trans. AGU*, *64*, 482, 1983.

Haxby, W. F., G. D. Karner, J. L. LaBrecque, and J. K. Weissel, Digital images of combined oceanic and continental data sets and their use in tectonic studies, *Eos Trans. AGU*, *64*, 995-1104, 1983.

National Research Council, *El Niño and the Southern Oscillation: A Scientific Plan*, Climate Research Committee, National Academy of Sciences, Washington, D. C., 1983a.

National Research Council, *Changing Climate*, Carbon Dioxide Assessment Committee, National Academy of Sciences, Washington, D. C., 1983b.

Rasmussen, E. M., and J. M. Wallace, Meteorological aspects of the El Niño/Southern Oscillation, *Science*, *222*, 1195–1202, 1983.

Seasat Special Issue II, *J. Geophys. Res.*, *88*(C5), 424 pp., 1983.

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Cover. Raw sidescan sonar image made by U.S. Navy fast frigate Robert E. Peary. The unusual geometry created by foreshortening and proximity to ship track (top of image) gives the image's uppermost portion the appearance (and to some degree the function) of a conventional reflection profile while portions immediately below are close to plan view. Left half of image illustrates two different compressions for the same trace. The 30 km × 900 km image (along about 14°30'N) illustrates four Mariana basin seamounts: two new discoveries (the two smaller ones), one guyot (flat top) and a seamount in the process of entering the Marianas trench (the depression to the right). The sharp edge (arrow) suggests breakup of this seamount has already begun, 50 km from the 9000-m deep trench axis. Current rates of plate movement will complete the destruction within 1 million years. The trench itself nicely illustrates the steeper downgoing side to the left and the horst-and-graben fault blocks on the forearc side to the right. (Photo courtesy of Peter B. Humphrey, University of Hawaii, Institute of Geophysics, Honolulu, HI 96822.

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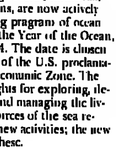
News & Announcements

AGU Ocean Sciences Award: Robert E. Wall



The Ocean Sciences Section of AGU recognizes the important, longstanding contributions of Robert E. Wall. Bob is rapidly approaching 20 years of dedicated and selfless service to the administration and promotion of ocean sciences within the federal government. He began his professional career as a staff scientist for marine geology and geophysics in the Office of Naval Research in the mid 1960's. In 1970 he moved to the National Science Foundation (NSF) as a program manager for marine geology and geophysics. In 1975, he was promoted to Head, Oceanography Section; Bob is now Head, Ocean Sciences Research Section.

Through all of this, Bob has managed to maintain a strong commitment to making the bureaucratic system work and to be concerned about the needs and goals of the individual scientist while recognizing the limitations and pressures within NSF. And he has maintained a sense of humor and his own personal integrity. His management philosophy is driven by a deep concern for the health and vitality of the ocean science community. This has translated into program-level operations which are driven by science.

Bob was educated in physics at Carlton College and later obtained a Ph.D in marine geophysics from Columbia University and Lamont-Doherty Geological Observatory. From this background, he has developed a strong interest in, and an impartial attitude toward, all aspects and subdisciplines of oceanography.

Some specific contributions made by Bob within NSF include the following:

He provided much of the intellectual guidance in merging "big" and "small" science at the end of the International Decade of Ocean Exploration. He has worked hard to maintain NSF's capability to support science across the full spectrum of project size and interdisciplinary content. For this, he was recognized by an NSF Special Achievement Award in 1981.

He has worked diligently to incorporate into facilities planning the perceptions of the research section on ship and equipment needs. He was instrumental in forming the first NSF research *and* facilities staff group to examine long-range needs.

He has maintained an acute awareness of the problems and research opportunities facing the community. Through publications, such as his article in *Eos* and presentations at AGU meetings, he has worked to keep the community informed of NSF/Division policies and activities. He has also led the fight to maintain proposal review panels as one of the methods of direct community involvement in the decision-making process.

He is a champion of the peer review system. Bob was also one of the first NSF managers to take action to set up ad hoc review committees to examine how well and how fairly his programs were utilizing the review system. The results: A pass with flying colors.

Bob is an unassuming and mindest individual. He is smart, thorough and strong—unusually strong for a person so compassionate about other people. For almost 15 years he has been a stabilizing influence for the good of academic ocean sciences in NSF and elsewhere. Not incidentally, Bob served as secretary of the AGU Oceanography Section in 1972–1974. It is high time he received recognition for his contributions to our science.

In summary, Bob Wall is truly an unsung hero, the kind of honest, dedicated, and effective administrator who we are all pleased to support in a position of responsibility in Washington, D. C. He is living testimony that "the system" can and does work with quality people in place. What is even better is that we can hope he will serve for another 20 years, quietly doing his important job superbly.

For the Ocean Sciences Section:
Christopher N. K. Mooers
President

Joseph L. Reid
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Peter G. Brewer
Secretary

December 1983

Ocean Drilling Update

Although planning for the first year of the Ocean Drilling Program (ODP) is well under way, the National Science Foundation (NSF) invites proposals from U.S. scientists and institutions for scientific and technological activities that "serve to enrich the scientific return from ocean drilling and ensure that ocean drilling is employed to the best advantage," according to Herman B. Zimmerman, ODP program associate for science coordination. Drilling operations for ODP are expected to begin in December (*Eos*, January 31, 1984, p. 33).

In the United States, NSF supports participation of U.S. scientists through the research support component of ODP. This support focuses on investigations of potential drilling regions, including studies that combine aspects of continental and marine geoscience; downhole geophysical experiments and development of related instrumentation; and workshops and other activities that focus on problem definition prior to drilling operations, Zimmerman said. To be considered for support, proposed projects must be clearly relevant to the drilling plans of the international community and focus on pre-drilling or drilling-concurrent activities, he explained. Where appropriate, proposals may be considered jointly by ODP and other research support programs within NSF and within other agencies.

Proposals may be submitted at any time and should be addressed to the ODP office, which has returned to the main NSF building at 1800 G St., N.W., Suite 1133, Washington, DC 20550 (telephone: 202-357-9849). Sandra Toye is ODP program director and Al Sutherland is associate director. ODP is under the aegis of NSF's ocean sciences division (*Eos*, July 5, 1983, p. 443).

Science direction for ODP is provided by the Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES). International participation in ODP will continue. In addition to the United States, membership in JOIDES is expected to include France, the United Kingdom, Japan, the Federal Republic of Germany, Canada, and a consortium of European nations represented by the European Science Foundation. Each member contributes to the financing, onboard science operations, and participates in science planning.

Geophysical Surveys

Joint Oceanographic Institutions, Inc., (JOI), a consortium of 10 major U.S. oceanographic institutions, was recently awarded a contract from the National Science Foundation to manage ODP (*Eos*, January 31, 1984, p. 33). JOI also manages the U.S. portion of the site survey program for ocean drilling. The survey program requires high-resolution geophysical surveys to facilitate site selection in preparation for deep ocean drilling. Organizations with the experience, ability, and interest to conduct required deep ocean geophysical surveys (including swath map surveys) should submit a written request for a copy of the solicitation (called JOI, Inc., RFP #1–84) from JOI, Inc., 2100 Pennsylvania Ave., N.W., Room 316, Washington, DC 20037, attention: Andrew A. Lukmanov. The efforts during 1984–1985 initially will focus on the Kane fracture zone and the Chile triple junction.

Books

Les Granites des Complexes Annulaires

Manuels et Methodes 4, Bernard Bonin, Bureau de recherches géologiques et minières, Orléans, France, 183 pp., 1982, in French.

Reviewed by Peter Bowden

This book, *Manual and Methods 4*, published by France's BRGM, together with a mouthwatering preface by R. Black promises much for the student of ring complexes. It consists of four distinct chapters, each divided into a number of subsections, with 52 text figures and 9 tables. Although in reality it is based on a doctoral dissertation concerned with the newly discovered ring structures in Corsica, it is spiced with references to past and present research in Nigeria, and observations from French expeditions to the Kerguelen Islands. There are also brief commentaries on the author's observations in New Hampshire and Massachusetts. The text effectively represents a distillation of knowledge concerned with oversaturated alkaline magmatism in continental and oceanic settings. The book has a good bibliography with English-language scientific literature references up to 1980. While aware that ring-complex compositions can be variable, ranging from calc-alkaline to alkaline, the author restricts his writings to granitic and related rocks of the alkaline and peralkaline spectrum.

Chapter 1 reviews the types of structures occupied by the granites and their mode of emplacement. This introductory section considers in detail the formation of ring structures in Corsica. These are Permo-Triassic in age, A-type granitoids of short-time duration following the main compressional tectonic regime of the Hercynian. There are several good field sketches with diagrammatic interpretations which may be valuable as a field guide to *the Corsican* ring complexes.

Bonin then launches into a series of theoretical observations based upon published scientific literature concerning the geometry of ring complexes (shape, average diameter, etc.) and the ascent and subsequent cooling history of magmatic liquids in ring dykes. This is followed by a nine-page commentary on the mode of emplacement of ring complexes, paying particular attention to the Glencoe and Valles models, and the Ramberg experiments. The chapter ends with speculation on the source region for alkaline magmatic liquids.

Chapter 2 gives details about the textures of alkaline granites and related rocks and provides a summary of their petrology and mineralogy. The value of this chapter varies considerably. For example, the feldspar section is worthy of careful reading, but the olivine and pyroxene sections are given too brief a coverage to be of value. The amphibole discussion is welcome and provides the reader with additional information to be used in conjunction with the excellent article by Giret et al. (*Canadian Mineralogist, 18*, 481–195, 1980). The micas also are given a good, brief appraisal with some fascinating projections showing compositional variations towards siderophyllite. The most poignant feature about the amphibole and mica sections is the recognition that certain compositions can crystallize at temperatures below the granite solidus. Chapter 2 closes with a limited discussion concerning accessory minerals. Apart from the meticulous study by Pupin on zircon morphology in alkaline granites, there is only brief coverage of other minerals.

Chapter 3 enters the realm of geochemistry with some wt. % diagrams designed to emphasize the magmatic evolution of the alkaline granites. Trace element data (U, Th; Rb/Sr) provides an insight into magmatic and postmagmatic processes but the data is restricted, with no major references to rare earths or other important trace-element discriminants.

The final chapter (4) consists of a petrogenetic review concerned with the origin and evolution of alkaline anorogenic magmatism. Brief excursions are made into the problems of source regions of magma generation, the ascent of the magma through the crust, and its contamination. The most interesting aspect in this chapter is the discussion concerning the origin of "lindinosite," a mafic-rich (nepheline + alkaline amphibole) rock occurring as enclaves, or within zones of cataclasis in peralkaline granite at Evisa, Corsica. Bonin provides a good synthesis of the world-wide occurrences of lindinosite and offers an interesting solution to its formation.

Books *(cont. on p. 44)*

Books (cont. from p. 43)

The principal reservation with this pocket volume is that it is neither a manual nor a "methods handbook" on granites in ring complexes, as advertised on the front cover. It is, however, a welcome treatise on the subject, and provides an extensive theoretical approach peppered with tantalizing glimpses of the author's own research in Corsica coupled with his remarkable grasp of the scientific literature.

Peter Bowden is with the Department of Geology, University of St. Andrews, Fife, Scotland KY16 9ST.

Water and Agriculture in the Western U.S.: Conservation, Reallocation, and Markets

Stud. in Water Policy and Management, vol. 2, G. Weatherford (Ed.), Westview, Boulder, Colo., xviii + 269 pp., 1982, $25.

Reviewed by William B. Lord

Water conservation has long been an unqualified good in the western United States. But when westerners have said "conservation," they have usually meant reservoir storage to prevent water from escaping downstream before it could be diverted and put to beneficial use. They took particular umbrage when the Carter Administration defined it to mean water demand management, a way of avoiding or postponing the construction of reservoirs. To oppose reservoir development in the West most certainly is to defy the conventional wisdom and to court political extinction. It is to brand oneself as daft or disloyal as well.

Several of the contributors to this book are academics who are also westerners by residence (if not by ideology), and who are well known for espousing the sort of heresy which brought so much western opprobrium down upon Jimmy Carter. Readers of *Eos* are now advised that they are at it again. The book is a report of a series of loosely interrelated research studies, all dealing with agricultural water use in the West, and all done under the sponsorship of the John Muir Institute. The theme of the research is the need to reallocate water from agriculture to higher-valued, non-agricultural uses, the institutional capacity (or lack of capacity) to do so, and the costs which conservation may impose on some water users.

A central distinction running through many of the contributions is that between what Dean Mann calls the "bureaucratic strategy" and the "market strategy" for allocating water. The authors clearly prefer the market strategy, because it accomplishes the required changes in water use at the lowest costs. They recognize that those costs, even if they are minimized, do exist, and that they will fall mostly upon farmers and Indians. But they begin with the presumption that transfers out of agricultural use are necessary, and that what is at issue is only the best way to do it. In fact, in much of the West the conflict still revolves around whether such transfers are needed, and not yet on how to accomplish them. But the research reported in this volume clearly shows that adjustment is already well under way, and that Western energies which are now expended upon resisting change might better be devoted to understanding and managing it.

The book includes a thoughtful conceptual discussion by Dean Mann and three quite diverse case studies of water reallocation and conservation: in the Tulare Basin, in the Navajo Indian Irrigation Project, and in the Central Arizona Project. Not only are these three settings diverse, but the viewpoints and methodologies of the authors also differ greatly. Finally, the book includes an examination of water transfer institutions which have evolved in four western states.

This book will not please the practitioners of traditional western water politics; it too clearly reveals the outdated basis for that game. Neither will it completely please those environmentalists for whom the new water conservation is an article of faith; the costs of conservation are revealed along with its inevitability. The less committed, however, will find in it a wealth of information about how social change is occurring and reallocation of scarce resources is taking place, as well as many insights into how the process of institutional change could be made more rapid, efficient, and equitable.

William B. Lord is with Policy Sciences Associates, Boulder, Colo., 80301.

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Postdoctoral Associate/Meteorite Studies. The Harvard-Smithsonian Center for Astrophysics has a postdoctoral opening for a well-qualified recent Ph.D. who wants to advance our understanding of the origin of planets by carrying out petrologic studies of meteorites. The appointment is for one year (renewable for a second year), beginning August 1. Familiarity with automated microprobe analysis is essential; some previous exposure to cosmochemistry is desirable. Please send inquiries to Dr. John A. Wood, Smithsonian Astrophysical Observatory, 60 Garden St., Cambridge, MA.

The Smithsonian Astrophysical Observatory is an equal opportunity employer.

Director of Budget and Planning. The National Center for Atmospheric Research (NCAR), located in Boulder, Colorado, is seeking a Director of Budget and Planning to act as chief aide and advisor to the Director of the Center, to design, execute and oversee NCAR's budget and planning process, develop funding process. NCAR is operated by the 53 institutions of the University Corporation for Atmospheric Research under the sponsorship of the National Science Foundation. Requirements for this position include: documented skill in managing the budget and planning functions in a high-tech organization or in a medium-to-large-sized university; evidence of good and consistent judgment, and effective negotiation and decision-making with diverse staff; documented skills in writing budget justifications and analysis; documented skill in managing several tasks at once, in making priority judgments among them and in working under tight time constraints; evidence of participation on high-level management teams; evidence of familiarity with the Federal budgeting practices and procedures.

Compensation will be commensurate with the responsibilities of the position and the demonstrated skills of the successful candidate.

Prospective candidates may apply by submitting a letter of candidacy and a curriculum vitae to/or obtain additional information from: G.W. Curtis, Director of Personnel/EOP, NATIONAL CENTER FOR ATMOSPHERIC RESEARCH, P. O. Box 3000, Boulder, Colorado 80307.

Equal opportunity/affirmative action employer.

Position in Geophysics (Applied Solid Earth)/University of California, Riverside. Visiting lecturer opening beginning 1 September 1984. Although the initial appointment will be as a Lecturer, and is annually renewable, the appointment could lead to a ladder faculty position the following year. Appointee would teach both undergraduate and graduate level courses in geophysics and tectonics. Ph.D. required, and evidence of excellent potential in basic research in any subfield of applied geophysics will be considered. In addition to teaching, research and service are required of faculty members at the University of California. Applicants should submit a current curriculum vita with names and addresses of three people who have agreed to provide references. Applications should be complete by April 1, 1984; however, late applications may be accepted until successful candidate is appointed. Send applications to: Dr. Shawn Biehler, Department of Earth Sciences, University of California, Riverside, California 92521.

The University of California is an equal opportunity/affirmative action employer.

College of Oceanography, Oregon State University/Two Faculty Positions. *Sediment Geochemist or Sedimentologist.* 12-month, tenure-track position as an Assistant or Associate Professor in the College of Oceanography. Ph.D. in earth science, marine geology, or marine geochemistry and strong potential or demonstrated ability to conduct grant-funded research required. The appointee will be expected to teach advanced courses in his or her specialty, supervise graduate student research, and develop a strong research program in marine sediments in at least one of the following areas: (1) mineralogy, (2) uranium series/radiochemistry, (3) stable isotope studies as applied to diagenesis, or (4) inorganic geochemistry.

Marine Geologist (Micropaleontology and Stable Isotopes). 12-month, tenure track position at an Assistant or Associate Professor in the College of Oceanography. Ph.D. in earth science, marine geology, or oceanography and have a strong potential or demonstrated ability to conduct grant-funded research required. The appointee will be expected to teach advanced courses in his or her specialty, supervise graduate student research, and conduct a strong research program in marine geology and stable isotopes with emphasis on paleoceanography and paleoclimatology. Send resume and names of three references by April 15 1984 to:
G. Ross Heath, Dean, College of Oceanography
Oregon State University, Corvallis, Oregon 97331
U.S.A.

Oregon State University is an Affirmative Action/Equal Opportunity Employer and complies with Section 504 of the Rehabilitation Act of 1973.

Clay Mineralogy/University of Illinois at Urbana-Champaign. The Department of Geology invites applicants for a tenure-track faculty position in clay mineralogy. We are seeking candidates who have clearly demonstrated the potential to be outstanding researchers in the general areas of mineralogy, crystallography and chemistry of clay minerals, in the origin, diagenesis, and metamorphism of argillaceous sediments and whose future research will complement our existing programs in the petrology and diagenesis of sediments, experimental studies of compaction and of kinetics of burial diagenesis, behavior of clay minerals during deformation, petroleum geology, and stable isotope geochemistry. In addition to the development of a strong research program, the successful candidate is expected to participate in all aspects of teaching and advising at the graduate and undergraduate levels.

The Department of Geology houses a variety of facilities for clay mineralogy research, including x-ray diffraction and fluorescence units, an atomic absorption spectrophotometer, two NMR spectrometers, an isotope-ratio mass spectrometer, and electron microprobes. Numerous other analytical services are available on campus, particularly at the Materials Research Laboratory where there is equipment for Auger electron spectrometry, x-ray photoelectron spectrometry, scanning electron microscopy, transmission electron microscopy, and ion microprobe studies.

This position is available immediately. PhD. is required. Rank and salary will be commensurate with experience and qualifications. For equal consideration, please submit a letter of application that includes a statement of current and future research interests as well as a curriculum vitae, bibliography and the names of at least 3 referees willing to comment on your qualifications and promise by April 1, 1984 to Dr. Albert V. Carozzi, Chairman, Search Committee, Department of Geology, 245 Natural History Building, 1301 W. Green Street, Urbana, IL 61801. Phone: 217/333-3008.

The University of Illinois is an equal-opportunity/affirmative action employer.

University of Oklahoma/Electronics Instrumentation Specialist. The School of Geology and Geophysics is accepting applications for a full-time Electronics Instrumentation Specialist. Principal responsibilities will include maintenance, calibration and user instruction for a new, computer-automated Rigaku XRD-XRF system, and maintenance and repair of electronic components of other lab facilities in the School. Additional opportunities could include involvement in the University's electron microscopy lab (SEM and TEM), and the development of a Van de Graaf-PIXE analytical system in collaboration with O.U. physicists. Applicants should have a B.S. in Geology, Chemistry, or Electrical Engineering or equivalent in experience; salary is commensurate with qualifications. Send curriculum vitae and names and addresses of three professional references to:

Dr. David London
School of Geology & Geophysics
University of Oklahoma
Norman, Oklahoma 73019

Deadline for applications is March 15, 1984.

The University of Oklahoma is an affirmative action/equal opportunity employer.

Research Associate. The Department of Earth and Space Sciences at SUNY Stony Brook invites applications for a Research Associate position. Candidates should be experienced in application of Electron Microprobe and Analytical Electron Microscope techniques to geologic materials. The Department has a JEOL 200CX Electron Microscope with EDS and will be purchasing a new Electron Probe in 1984. Duties will include equipment maintenance, instruction of graduate students on equipment use and research with independent and in conjunction with faculty. Familiarity with computers and Fortran programming required. A PhD is preferred. Salary is negotiable, but we anticipate a range of $18–23K.

Send letter of application, resume and names and addresses of three references by March 31, 1984 to: Dr. Steven Bolden, Department of Earth and Space Sciences, SUNY Stony Brook, Stony Brook, NY 11794.

SUNY Stony Brook is an equal opportunity/affirmative action employer. AK# 7-84.

Mineralogical Society of America. Applications are invited for the position of Executive Secretary. The MSA Executive secretary is the member of the staff of the American Geophysical Union in Washington, D.C. who is responsible for managing the business activities of the Society. Duties include involvement in activities such as membership, accounting, publications, subscription fulfillment and meeting arrangements. Scientific, management, and/or publication background is desirable; dedication, organizational ability, and some knowledge of computer record management are essential. Salary from $23,000 depending on qualifications and experience. Send resume and names of three references to: Mineralogical Society of America, 2000 Florida Avenue, N.W., Washington, D.C. 20009.

Hydrologist/Georgia Institute of Technology. Georgia Institute of Technology, School of Civil Engineering, has a tenure track position available in hydrology at the assistant or associate professor level. The emphasis is on physical hydrology, ideally urban and surface water hydrology. Ph.D. is required. Teaching of undergraduate and graduate courses as well as the acquisition of funded research is expected. Send resume and list of references to: Professor J. Edmund Fitzgerald, Director, School of Civil Engineering, Georgia Institute of Technology, Atlanta, GA 30332.

Georgia Institute of Technology, a unit of the university system of Georgia, is an equal opportunity/affirmative action employer.

Planetary Geologist/Brown University. Tenure track Assistant to Associate Professor position starting July 1, 1984, or as soon as possible thereafter to teach and conduct research in planetary geologic processes on Earth and other planets. Research should be on understanding the physical processes (for example, impact cratering, volcanism, tectonism) responsible for the origin of planetary surfaces. Applicants must have Ph.D. in planetology, geophysics or geology. Deadline for applications is March 1, 1984. Interested parties should send vita and names of at least three persons we may contact for recommendations to: M.J. Rutherford, Chairman, Department of Geological Sciences, Brown University, Providence, RI 02912.

An equal opportunity/affirmative action employer.

Research Position/Department of Oceanography, University of British Columbia. Recent Ph.D. with experience in statistical methods and geophysical fluid dynamics sought to participate in the analysis and interpretation of data from an array of cyclesondes (profiling current meter, CTD systems) and current meters in the Strait of Georgia. The candidate should also have the potential of modelling the observations in terms of the non-linear low frequency motion of a stratified fluid of variable depth. The position is available as of 1 November, 1984, for a duration of one year and may be renewed for a second year; it will be filled at postdoctoral (ca $20,700) or research associate (up to ca $27,000) level according to the candidate's experience. In accordance with Canadian immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. Resumes and three letters of reference should be sent 1 July 1984 to Dr. S. Pond, Dept. of Oceanography, 6270 University Blvd., Vancouver, B.C., Canada V6T 1W5.

Marine Research Associate III. Process, analyze and interpret satellite derived thermal IR data of the Sargasso Sea from the subtropical convergence to the Gulf Stream. Prepare scientific manuscripts on the results emphasizing the near surface mesoscale dynamics and air/sea interaction. Ph.D. in Physical Oceanography and experience in computer programming. Submit resume by March 1, 1984, to: Peter Cornillon, Marine Research Associate III Position, University of Rhode Island, P.O. Box 357, Kingston, Rhode Island 02881-0357.

An affirmative action/equal opportunity employer m/f.

Postdoctoral Position/University of Washington. Research Associate (postdoctoral) with background in physical oceanography or atmospheric sciences and interests in dynamical aspects of climate variability. Term of appointment: one (1) year, renewable for a second year subject to the approval of the Council. Closing date: March 15, 1984. Send curriculum vitae and a list of four (4) references to Director, JISAO, c/o Department of Atmospheric Sciences, AK-40, University of Washington, Seattle, WA 98195.

An equal opportunity/affirmative action employer.

Space Plasma Theoretician/Princeton University. A postdoctoral position is available beginning summer of 1984 in the Theoretical Division of the Plasma Physics Laboratory, Princeton University, for one year with the possibility of renewal for a second year. Physicists with a Ph.D. degree or its equivalent or other relevant discipline are encouraged to apply. The position involves theoretical and numerical simulation studies on space plasma physics under the support of the National Science Foundation. Interaction with the members of the Laboratory engaged in fusion plasma physics is encouraged. Interested candidates should send a resume and three letters of recommendation to: Dr. H. Okuda, Plasma Physics Laboratory, Princeton University, Princeton, NJ 08544.

Princeton University is an equal opportunity/affirmative action employer.

Geophysics/Oregon State University. Applications are invited for a 12-month, tenure track position for an Assistant or Associate Professor of Geophysics in the College of Oceanography to complement the present eight member Geophysics faculty. The applicant must have a Ph.D. or equivalent, a demonstrated ability to conduct independent research in theoretical or observational geophysics, and to obtain research funding. Applicants will be considered in most areas of solid earth geophysics. Duties include teaching graduate courses in geophysics, supervising graduate students, and developing a program of grant-funded research. Interested candidates should submit a resume, names of three references, and a brief statement of research plans by March 1, 1984, to: G. Ross Heath, Dean, College of Oceanography, Oregon State University, Corvallis, Oregon 97331.

Oregon State University, an affirmative action/equal opportunity employer, complies with section 504 of the Rehabilitation Act of 1973.

Postdoctoral Fellowship: Hydrogeology. Applications are invited for a postdoctoral position at the University of British Columbia. Starting date: July 1, 1984; two years, with possible extension for a third year. Specific research task will require familiarity with hydrogeologic environments, contaminant transport, and numerical modeling. Open to candidates from Geology or Engineering. Salary: at least $20,700 Canadian. Applications with resumes and addresses of three referees should be sent to: Dr. R.A. Freeze, Department of Geological Sciences, University of British Columbia, Vancouver, B.C., Canada, V6T 2B4. For further information, telephone (604) 228-6162.

Research Position in Space Plasma and Auroral Physics. Two research positions at the level of assistant or associate research scientists are available in the Department of Physics & Astronomy at the University of Iowa for qualified candidates with a Ph.D. degree and experience in space plasmas and/or auroral physics. Present research in space plasma physics emphasizes analysis and interpretation of observations of magnetospheric plasmas using instrumentation on board earth-orbiting spacecraft in the IMP and ISEE Missions. The University of Iowa's global imaging instrumentation on the spacecraft Dynamics Explorer 1 is the source of an extensive data base of auroral images from high altitudes at visible and ultraviolet wavelengths. Photometric observations are also available for other areas of research including the physics of the upper atmosphere and the global distribution of atmospheric ozone. The applicant should identify and describe areas of his or her expertise which can support experimental or theoretical investigations in space plasma physics and/or auroral physics. Salary and position will be determined by the applicant's qualifications and experience.

A resume and the names of three persons knowledgeable of applicant's experience should be forwarded to: L. A. Frank, Department of Physics & Astronomy, University of Iowa, Van Allen Hall, Iowa City, Iowa 52242.

The University of Iowa is an affirmative action/equal opportunity employer.

Program Manager/Air-Sea Interaction. NASA Headquarters' Oceanic Processes Branch is seeking candidates for planning, developing and implementing a scientific research program utilizing satellite techniques in the general area of air-sea interaction. Specifically included is the use of satellite scatterometry to characterize the surface wind field and the effect of surface winds on upper-ocean currents. Qualifications include 1) ability to communicate effectively, 2) demonstrated experience in conducting original research, 3) program management experience, and 4) knowledge of physical oceanography. GS 14/15, with salary ranges from $41,277 to $63,115, commensurate with experience/education. For further information regarding requirements and application procedures write to address below or phone 202-755-3687. Formal applications must be received by May 6, 1984.

NASA Headquarters, Code NHP, Washington, D.C. 20546.

An equal opportunity employer.

Massachusetts Institute of Technology, Haystack Observatory: Scientist/Engineer. The Haystack Observatory is seeking a Scientist/Engineer to work in the field of Very Long Baseline Interferometry (VLBI). The Scientist/Engineer would assist in the development of new VLBI data acquisition electronics as well as assist with the processing and analysis of data taken for the NASA Crustal Dynamics Project. The applicant should have a Ph.D. or its equivalent in radio astronomy or related field. Some engineering knowledge and experience with electronics is needed and a knowledge of computer and microprocessor programming would be an asset.

Please write, enclosing resumes to:

J.T. Karaku
Assistant to the Director
Haystack Observatory
Westford, MA 01886.

M.I.T. is an equal opportunity/affirmative action employer.

Remote Sensing Chair/Visiting Professorship. August 16, 1984, to June 15, 1985. Some variation of these dates is possible. Excellent opportunity for individual who desires to do research while teaching a very light load in the field of his expertise. The U.S. Naval Academy, located in historic Annapolis on the shore of beautiful Chesapeake Bay, is near Washington, D.C. and Baltimore, MD. Salary commensurate with applicant's background. Considerable latitude of action exists in travel, publishing, etc. Within limitations funding for travel is available. Earned Ph.D. required. Please send resume and list of publications together with the names and addresses of three references to: Professor John F. Hullinan, Chairman, Faculty Search Committee, Oceanography Department, U.S. Naval Academy, Annapolis, MD 21402. Closing date: March 1, 1984.

An equal opportunity employer.

The University of New Mexico/Mass Spectrometry. The Department of Geology, University of New Mexico, Albuquerque, is seeking applicants for a Research Associate III position in the stable isotope laboratory. The position includes responsibility for operation and maintenance of mass spectrometers and high vacuum extraction systems, sample preparation and isotopic analyses. The position also provides opportunities for collaborative research in isotope geochemistry leading to publication. A Ph.D. in geochemistry, inorganic chemistry or physical chemistry with research experience involving mass spectrometry and high vacuum technology is required. Salary range is $16,000 to $24,000. Send a letter of application, resume, and the names and addresses of three individuals willing to serve as references to: Crayton J. Yapp, Department of Geology, University of New Mexico, Albuquerque, NM 87131. Closing date for applications is March 1, 1984.

The University of New Mexico is an equal opportunity/affirmative action employer.

SERVICES, SUPPLIES, COURSES, AND ANNOUNCEMENTS

THE ARCTIC SCIENCE PRIZE

The North Slope Borough is pleased to announce the establishment of The Arctic Science Prize. The Prize ($10,000) is to be given to distinguished scientists who have made significant contributions to man's understanding of natural processes in the Arctic. The purposes of the Prize are: to serve as recognition of the recipient's contributions, to further stimulate excellence in arctic science, and to focus attention upon the Arctic and its unique problems. An 11 member Candidate Review Committee will make the nominations and select the recipient.

The North Slope Borough is a local jurisdiction (county-like) that occupies most of the Alaskan Arctic. The Borough is very large (88,000 square miles) and sparsely populated (approximately 9,000 people).

Further information regarding the Arctic Science Prize can be obtained from:

Eugene Brower, Mayor
North Slope Borough
Box 69
Barrow, Alaska 99723

STUDENT OPPORTUNITIES

Opportunity for Graduate Study in Igneous Petrology/Isotope Geochemistry—Southern Methodist University. The Department of Geological Sciences at Southern Methodist University in Dallas, Texas seeks outstanding individuals interested in a PhD program in igneous petrology and/or isotope geochemistry. The successful applicant should have a strong background in geology, chemistry, and mathematics and an interest in volcanic processes. Research will involve participation in a field-oriented petrological, geochemical, and isotopic study of Late Cenozoic volcanism in the Chilean Andes. For further details and applications please contact either:

Dr. R. S. Harmon (214) 692-3075
or
Dr. M. A. Dungan (214) 692-2752
Department of Geological Sciences
Southern Methodist University
Dallas, Texas 75275.

AGU

AGU Membership Applications

Applications for membership have been received from the following individuals. The letter after the name denotes the proposed primary section affiliation.

Henry D. I. Abarbanel (O), Julia C. Allen (H), Gwendolyn L. Anson (GP), Andrew Bakun (H), C. A. Bengtson (T), Patricia A. Berge (S), Peter R. Betzer (O), Pierre Boivin (V), Michael V. Capobianco (P), Martin C. Chapman (S), Chu-Yung Chen (V), Timothy J. Clarke (S), Steven C. Constable (GP), Michele Dermer (H), G. M. Dow (T), Carl E. Draper (G), Dean A. Dunn (O), I. B. Everingham (S).

Patricia Ford-Hall (S), Alberto Giesecke (S), Cyrena Anne Goodrich (V), J. Frederick Grassle (O), Maryann G. Helferty (T), Ola Johannessen (O), Jeffrey T. Kiehl (M), Jeffrey Paul Laible (H), Lisa M. Lopez (S), Peter A. Lundberg (O), Kiyoshi Maezawa (SM), Nuryasu Masuda (V), Ronald K. Mathener (V), Cathy McGuire (G), C. Dan Miller (V), J. Dennis Newbold (H), Brian C. Nichols (S), Tevfik Demir Ozcandarli (T), John S. Perry (A), G. Stephen Pitts (T), John C. Pohlman (S), John M. Quinn (GP), I. D. Ripper (S), Heinrich Rohlenburg (H), Sei-Ichi Saitoh (O), Hideo Sakai (GP), Avi Shapira (S), Patricia Thacker (V), Marco Unguendoli (G), Jan L. Zigler (D).

Student Status

Rashid Alabou (H), Sandra Anderson-Fontana (T), Craig A. Barker (S), Kenneth Belitz (H), Horst A. Beyer (G), Donna S. Buxton (H), Cass Wayne Caruso (S), Thomas Cahill (M), Craig A. Chesner (V), Sharon A. Chessom (T), Race Cleary (SA), Deborah M. Crooks (V), Sven Dahlgren (V), Scott D. Davis (S), Alfred V. Dehurst (S), Michael C. Dix (T), Michael Dones (T), David M. Gleason (G), Mark B. Gordon (T), Gordon Grant (H), Polli M. Groth (T), Wei Min Hao (A), Mariano Hernandez Navarez (H), James Hibbard (T), Elizabeth K. Hill (T).

John L. Isbell (SM), Jeffrey A. Johnson (T), Wendy C. Leonard (H), Jordan B. Maler (H), Miriam H. McGovern (V), Oscar J. Mesa (H), Talal Molnar (S), James E. Nell (SM), Duke E. Ophori (H), Brent E. Owens (V), Mark H. Parrott (GP), Jorge F. Pemarlo (S), Cecile Penland De Garcia (O), William R. Pierson (T), Mark Reid (H), Richard W. Robbins (H), Toshitaka Suzuki (V), Michael C. Tseng (T), Zhijung Wang (T).

Meetings

Meeting Report

NASA Data Systems Users

A considerable evolution has occurred in the past two decades in the disciplines of solar-terrestrial and interplanetary physics. Early research was centered around exploratory missions in which measurements from individual scientific instruments could be meaningfully employed to advance our state of knowledge. As these scientific disciplines have advanced, a much more profound, and interrelated, set of questions is being posed by researchers. The result is that present-day investigations are generally much more complex: large volumes of data are acquired from multiple sensors on individual spacecraft or from ground-based systems and, quite often, data are needed from multiple sources in order to address particular physical problems.

It is clear that research in solar-terrestrial physics during the 1980's and beyond will be devoted to intense multidisciplinary studies aimed at exploring very complex physical questions (see the National Academy of Sciences' *Solar-Terrestrial Research for the 80's*). It is in this spirit that the NASA Data Systems Users Working Group recognizes that major future advances in solar and space physics will require close collaboration among investigators through interactive exchanges of scientific information. Increasingly, scientists spend large amounts of time contacting other researchers to obtain data needed to solve given problems. Such problems are exacerbated by the lack of standards for scientific data bases. The net result is that, at present, most researchers recognize the value of multidisciplinary studies, but the cost in time and effort is devastating to the research efforts. This trend is antithetical to the needs of solar and space physics research.

Some 40 scientists and data system managers met at the Los Alamos National Laboratory July 13–July 15, 1983, to address these problems. The participants are representatives of major space research organizations who serve in the NASA Data Systems Users Working Group (DSUWG), a committee formed in 1980 to advise NASA on matters related to data acquisition, storage, and dissemination and currently chaired by D. N. Baker of Los Alamos.

The bulk of the meeting was directed toward making recommendations to NASA management concerning the establishment of a Space Physics Analysis Network. Other committees within the space science community have come forward recently with similar recommendations. The National Academy of Sciences (NAS) Committee on Data Management and Computing (CODMAC) is presently working on its second major report, which contains as a subset many recommendations which are consistent with those of the DSUWG. In addition, the special joint data panel formed by the Committee on Solar and Space Physics and the Committee on Solar-Terrestrial Research (CSSP/CSTR) of the NAS recently finished its report, and one of its primary recommendations is the establishment of a computer network within the space physics community.

Within this framework, the DSUWG recognizes that computer networking holds the most promise of meeting collaborative scientific requirements in the most efficient and cost effective manner for archived, current, and future data bases. The DSUWG therefore recommends that NASA establish a solar and space physics pilot program to create a Space Physics Analysis Network (SPAN) that would link together a large number of NASA space scientists.

The DSUWG recommends that SPAN conform to several further guidelines. The network must function so that users' needs are addressed while maintaining a stable environment for facilitating correlative scientific research. The network should be built by using available but state-of-the-art components from hardware through software with the idea that SPAN will become a test bed for the design of data systems for future projects. The inclusion of the NSSDC within this network to act as a central library and data catalog center is highly desirable at a very early stage. This same recommendation has been made by the CSSP/CSTR data panel.

The solar and space physics pilot program should coordinate its efforts with those of other pilot programs within NASA, and with other interested agencies (e.g., NOAA, DOE). We also suggest that SPAN should use as its foundation the current SCAN system based at Marshall Space Flight Center.

This meeting report was contributed by D. N. Baker *and* R. D. Zwickl *of Los Alamos National Laboratory, Los Alamos, NM 87545 and* J. L. Green *of NASA Marshall Space Flight Center, Huntsville, AL 35812.*

Announcements

Seismic Deconvolution

July 18–20, 1984 Seismic Deconvolution Workshop, Vail, Colo. Sponsor, Society of Exploration Geophysicists. (Sven Treitel, Amoco Production Co., Research Center, P.O. Box 591, Tulsa, OK 74102.)

The program will consist of invited talks, panel discussions, and contributed poster papers on the following topics: multiple attenuation, practical deconvolution, model validation, wavelet estimation and removal, and quantitative measures of success. The emphasis will be on real data cases, and invited speakers will include Ken Larner (keynote address), Enders Robinson, Bill Schneider, Andrejs Jurkevics, Paul Newman, Turhan Taner, Doug Oldenburg, Terry Deeming, and John Burg.

Those who wish to present poster papers at the workshop should send an abstract to the above address by March 15.

Magnetic Anomalies

August 5–17, 1985 Symposium on Magnetic Anomalies Over the Margins of Continents and Plates, Prague, Czechoslovakia. Sponsor, International Association of Geomagnetism and Aeronomy. (William J. Hinze, Department of Geosciences, Purdue University, West Lafayette, IN 47907; telephone 317-494-5982.)

The symposium will deal with current research in using magnetic evidence to identify and characterize continental margins and the margins of present and ancient plates. Papers will be presented orally, and those who wish to submit abstracts for the session are asked to notify the symposium convenor by April 1.

Remote Sensing

October 8–11, 1984 1984 World Conference on Remote Sensing, Bayreuth, West Germany. Sponsors, University of Bayreuth, Texas Christian University Center for Remote Sensing and Energy Research, and International Society of Toxicological and Environmental Chemists. (Leo W. Newland, Director, Environment Sciences Program, Texas Christian University, Fort Worth, TX 76129; telephone 817-921-7271.)

The program is divided into two segments, a symposium on resource management and environmental planning (October 8–10), and a workshop on acid rain and hazardous materials (October 11.) Included in the program will be plenary sessions, poster presentations, exhibits, and discussion groups.

All contributed papers for this conference will be presented as posters. The deadline for abstracts is April 1.

Geothermal Resources

August 26–29, 1984 Geothermal Resources Council 1984 Annual Meeting, Reno, Nev. (Geothermal Resources Council, P.O. Box 1350, Davis, CA 95617; telephone 916-758-2360.)

The technical program will consist of presentations on geothermal exploration and development, drilling technology, reservoir engineering, high and low temperature power generation, direct use, and the legal, institutional, economic, marketing, and financing aspects of geothermal energy. The deadline for submitting papers is April 2, with format instructions available from the above address.

The Geophysical Year calendar last appeared in the December 6, 1983, issue.

GAP

Separates

To Order: The order number can be found at the end of each abstract; use all digits when ordering. Only papers with order numbers are available from AGU. *Cost:* $3.50 for the first article and $1.00 for each additional article in the same order. Payment must accompany order. Deposit accounts available.

Copies of English translations of articles from Russian translation journals are available either in unedited form at the time of their listing in EOS or in final printed form when a journal is published. The charge is $2.00 per Russian page.

Send your order to:
American Geophysical Union
2000 Florida Avenue, N.W.
Washington, D.C. 20009

Exploration Geophysics

0910 Computer applications
OPTIMUM SUPPRESSION OF COHERENT SIGNALS WITH LINEAR MOVEOUT IN SEISMIC DATA
M. Simaan (Department of Electrical Engineering, Interactive Computing Laboratory, University of Pittsburgh, Pittsburgh, PA 15261) P. L. Love
This paper presents a new technique for suppression of coherent signals with linear moveout in seismic data. This technique is implemented in two schemes which take an array of traces as input and produce either one single trace or another array of traces as output. Two seismic applications are discussed in detail. The first is in the area of separation of upward and downward travelling signals in vertical array seismology, and the second is concerned with the attenuation of ground roll in conventional land data and cable noise in marine data, respectively. In each case, an example of real seismic data is presented to illustrate the effectiveness of this technique.
GEOPHYSICS, VOL. 49, NO. 3

0920 Magnetic and electrical methods
INDUCED POLARIZATION TIME-DOMAIN EQUIPMENT AND STUDIES OVER THIN DIKES OF FINITE STRIKE EXTENT
R. S. Majumdar (Geophysics Lab, Dept. of Geological Sciences, Jadavpur University, Calcutta 700 032, India; [illegible] Lecturer, Asmara University, Ethiopia) S. Dutta
An induced polarization unit designed for model [illegible] multiple choices of current pulse widths and constan[t] [illegible] described. The percentage polarizability is estimat[ed] [illegible] recorded decay potential. Model results with differe[nt] [illegible] presented and discussed over a plate-like body for v[arious] [illegible] and inclinations. Field cases are presented for co[mparison with] model results.
GEOPHYSICS, VOL. 49, NO. 3

0920 Magnetic and electrical methods
EVALUATION OF AN OBSERVATIONAL METHOD FOR ESTIMATION OF REMANENT MAGNETIZATION
C. C. Schnetzler (Geophysics Branch, NASA/Goddard Space Flight Center, Greenbelt, MD 20771) P. T. Taylor
This paper evaluates an observational method proposed by Zietz and Andreasen (1967) for estimating the remanent magnetization of a body from aeromagnetic data. Their method uses the position and relative intensity of the maximum and minimum produced by the causative body to infer the declination δ and inclination ι of the total magnetization vector of the body. A series of plots which summarize over 800 modeled fields is presented which illustrate the utility and limitations at main field inclinations of 0, 30, 60, 75, and 90 degrees. As a general rule, the method is relatively insensitive for the estimation of δ and ι near the geomagnetic equator, but it becomes increasingly sensitive toward the geomagnetic poles. However, the sensitivity is a complicated function of both δ and ι at any magnetic latitude. Examination of the applicability of this method indicates that under limited circumstances magnetization declination δ can be estimated, but due to the zero-level ambiguity inclination of the magnetization ι is indeterminate.
GEOPHYSICS, VOL. 49, NO. 4

0930 Seismic methods
SEMBLANCE PROCESSING OF BOREHOLE ACOUSTIC ARRAY DATA
Christopher V. Kimball (Schlumberger-Doll Research, P.O. Box 307, Ridgefield, CT 06877) Thomas L. Marzetta
A new method of processing borehole acoustic array data is described. The method detects arrivals by computing the scalar *semblance* for a large number of possible arrival times and slownesses. Maxima of semblance are interpreted as arrivals, and their associated slownesses are plotted on a graph whose axes are slowness and depth. The processing makes few prior assumptions about the data and the algorithm is uncomplicated.
Results of the processing applied to data from a 12-receiver device are presented for both open and cased holes.
GEOPHYSICS, VOL. 49, NO. 3

0930 Seismic methods
POSTSTACK ESTIMATION OF THREE-DIMENSIONAL CROSSLINE STATICS
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In three-dimensional land data acquisition, the crossline dimension of the receiver spread is often much smaller than the inline dimension, typically for reasons of economy. Because of fundamental wavenumber limitations in the estimation of residual statics by prestack surface consistent methods, unresolved static errors will persist through processing to the stack data, particularly in the crossline direction.
The present method involves an analysis of poststack 3-D data through the creation of a correlation time surface from crosscorrelations of adjacent stack data traces. This time surface is decomposed in the wavenumber domain to isolate and correct some of the spectral components of residual static errors which are beyond the resolution of prestack approaches. Assumptions are implicit within the method regarding the expected 2-D wavenumber nature of the wave field response of true geologic structure. The method is proposed as an additional procedure to the standard 3-D processing sequence for land data.
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